If you are using a printed copy of this procedure, and not the on-screen version, then you <u>MUST</u> make sure the dates at the bottom of the printed copy and the on-screen version match. The on-screen version of the Collider-Accelerator Department Procedure is the Official Version. Hard copies of all signed, official, C-A Operating Procedures are kept on file in the C-A ESHQ Training Office, Bldg. 911A

C-A OPERATIONS PROCEDURE MANUAL

1.5.3 Procedure to Open or Close Breakers and Switches and Connecting/Disconnecting Plugs

Text Pages 2 through 4

<u>Hand Processed Changes</u>

HPC No.		Date	Page Nos.	Initials
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Approved: _____***<u>Signature on File</u>***_____ _____
Collider-Accelerator Department Chairman Date

R. Karol

1.5.3 Procedure to Open or Close Breakers and Switches and Connecting/Disconnecting Plugs

1. Purpose

1.1 To provide PPE requirements for operating any manual breaker or disconnect switch until engineering calculations or analyses are completed, documented and approved. These requirements meet BNL PPE requirements in Reference 5.1.

1.2 To provide PPE requirements for connecting or disconnecting equipment with plugs and line coords to energy sources.

1.3 To provide documented assurance to C-AD shift or support personnel who operate breakers or disconnects for other groups, that it is safe to open and/or close the breaker or switch when requested to do so.

2. Responsibilities

None

3. Prerequisites

3.1 Only trained and qualified workers may use this procedure.

3.1.1 A qualified worker is trained and knowledgeable of the operation of equipment or a specific work method and is trained to recognize and avoid the electrical hazards that might be present with respect to that equipment or work method. Such persons must also be familiar with the proper use of the special precautionary techniques, personal protective equipment, including arc-flash, insulating and shielding materials, and insulated tools and test equipment. A person can be considered qualified with respect to certain equipment and methods but still are unqualified for others.

3.1.2 All work must be planned. See C-AD OPM 2.28.

3.1.3 Before a shift or support worker is asked to open or close a breaker or switch because the workers performing the work need their assistance because they don't have the proper PPE, the work planner of the job must provide the shift or support worker with a completed "Authorization to Safely Open or Close Breakers or Disconnect Switches as Part of Planned Work Processes", Attachment 2 to this OPM.
Exception: OPM 2.6.1 and 2.6.4 are exempt from this requirement.

4. Precautions

4.1 Never wear meltable fiber clothing (acetate, nylon, polyester, polypropylene, or spandex), underneath any required PPE (exception is incidental amount of elastic on underwear or socks).

4.2 Switches and breakers should not be operated if obviously damaged.

4.3 All breaker or switch operations are to be done with covers closed and properly secured. For troubleshooting or investigation only, switches/breakers may be operated with covers open when work planning has been accomplished with supervisor's approval.

4.4 Line cords, plugs and receptacles shall be inspected for signs of damage or misuse before any attempt is made to connect them.

4.5 Equipment to be plugged shall be turned off before connecting to the energy source.

4.6 If the receptacle is configured with a local switch, the switch shall be turned off before connecting to the load.

5. Procedure

CAUTION:

C-AD has started a program to inspect the GE Spectra Series Fuse Disconnect Switches at C-AD facilities. The design and construction of the switches does not appear suitable for long term operation. Not all models of this switch have been inspected to date. C-AD plans to inspect all switches of this series and replace them as appropriate during the upcoming 2006 summer shutdown. It is extremely important to wear the correct PPE at all times, but especially when operating any GE Spectra Series Fuse Disconnect switch. Currently there are Yellow "Do Not Operate" or Red "Hold Tags" on all 400 ampere switches of this series (Figure A). Other switches of these series may be operated when wearing PPE as outlined in Table 1.

If there are any questions related to these switches, contact Jon Sandberg (631-806-8731 or x4682).

NOTE:

1. If you operate any breaker or disconnect that has no PPE label or has a generic PPE label (Figure B), then follow the PPE requirements of this section.
2. If a panel or individual breaker or disconnect switch has a label that specifies the PPE requirements, then follow those requirements (see example specific label in Figure C) instead of the requirements below.

5.1 Identify and use precautions appropriate to the working environment.

5.2 Wear proper personal protective equipment (PPE) as listed in Attachment 1 "PPE Requirements for Operating Circuit Breakers and Disconnect Switches (not wall light switches) Rated 50 Volts to 600 Volts.

5.3 When connecting or disconnecting plugs to single-phase receptacles rated at 110 volts or 220 volts AC, and less than or equal to 30 amps, no PPE is required.

5.4 When connecting or disconnecting plugs to receptacles rated at greater than those specified in paragraph 5.3, use the PPE required to operate a switch of a similar rating from Attachment 1, Tables 1 and 2.

5.5 Always use the rating/configuration of the receptacle to determine the PPE required.

5.6 When receptacles are labeled with a specific hazard category, one shall use the PPE listed on the label.

6. Documentation

6.1 Completed "Authorization to Safely Open or Close Breakers or Disconnect Switches as Part of Planned Work Processes", Attachment 2 to this OPM shall be maintained by the group performing breaker/switch operations.

7. References

7.1 ESH 1.5.0 Appendix VIII: Personal Protective Equipment (PPE) for Electrical Work, Rev. 1.

8. Attachments

8.1 BNL PPE Requirements for Opening Circuit Breakers and Disconnect Switches (not wall light switches) Rate 50 Volts to 600 Volts.
8.2 Authorization to Safely Open or Close Breakers or Disconnect Switches as Part of Planned Work Processes.
8.3 Figure A – Example of GE Spectra Series 400A Fuse Disconnect Switch.
8.4 Figure B – Generic PPE Label.
8.5 Figure C – Example of a Specific PPE Label

Attachment 1

BNL Personal Protective Equipment (PPE) Requirements For Operating Circuit Breakers and Disconnect Switches (Not wall light switches) Rated 50 Volts to 600 Volts

(See Table 2 below for required PPE)

1. In all cases, clothing and equipment required for the degree of exposure is permitted to be worn alone or integrated with flammable, non-melting apparel. If FR clothing is required, it must cover associated parts of the body, as well as all flammable apparel while allowing movement and visibility. PPE equipment will normally be used in conjunction with one another as a system to provide the appropriate level of protection. Clothing must cover potentially exposed areas as completely as possible. Shirt sleeves must be fastened at the wrists, and shirts and jackets must be closed at the neck.

2. The PPE requirements listed in Table 1 below are based on arc-flash calculations or voltage and ampere rating of the equipment rather than only voltage. Do not wear "meltable" fiber clothing (acetate, nylon, polyester, polypropylene, or spandex) underneath any required PPE clothing (exception is incidental amount of elastic on underwear or socks). **The BNL required PPE differs from the NFPA 70E tables to provide an enhanced margin of safety.**

Notes to be used for Tables 1 and 2 of this Attachment:

Note 1: These requirements are for operating switches and disconnects. For working on equipment powered from switches or disconnects, refer to BNL PPE Requirements for Working On or Near Energized Circuits in ESH 1.5.0 Appendix VIII for required PPE unless specific arc-flash information is listed on the equipment or in Work Planning documentation.

Note 2: Rayon, a natural fiber made from cellulose, is allowed in NFPA 70E.

Note 3: The equipment Ampere rating is always the nameplate rating of the panel that the switch or circuit breaker is installed in and the Voltage is the line-to-line operating Voltage of the equipment.

Note 4:

In the C-AD complex, switches and breakers tapped from "Royal Switches" must use the Royal Switch Rating (greater than 225 A).

Table 1. Hazard Risk Category Classifications

Equipment	*Voltage*	*Ampere* *[Notes 3 and 4]*	*BNL PPE Rating*	
In all cases, if there is a label on the equipment that lists required PPE, you must use at least that PPE.	Less than 600 V		Example is Light and Power panels fed from 30-KVA transformers only require safety glasses.	
Circuit Breaker Panels or Disconnect Switches operating at less than or equal to 240 V and rated less than or equal to 225 A	Less than or equal 240 V	Less than or equal 225 A	NFPA 70E Cat. 0 PLUS leather palm gloves	
Circuit Breaker Panels or Disconnect Switches (excluding 277 V wall light switches) operating more than 240 V and rated less than or equal to 225 A	More than 240 V	Less than or equal 225 A	NFPA 70E Cat. 2 (8 Cal/cm^2)	
Circuit Breaker Panels or Disconnect Switches operating at less than or equal to 240 V and equipment rated greater than 225 A	Less than or equal 240 V	Greater than 225 A	NFPA 70E Cat. 2 (8 Cal/cm^2)	
Operating controls on 480-V Motor Control Centers or individual motor starters	Less than 600 V	Starter Size <4 (50 Hp or less)	NFPA 70E Cat. 2 (8 Cal/cm^2)	
		Starter Size 4+ (51 Hp or more)	Arc Flash Hazard Analysis completed	PPE as listed on panel
			Work Planning performs arc flash analysis	PPE as listed on Permit
			No Arc Flash Hazard Analysis	NFPA 70E Cat.4 (40 Cal/cm^2)
Circuit Breaker Panels or Disconnect Switches operating at greater than 240 V and rated greater than 225A	More than 240 V	Greater than 225 A	Arc Flash Hazard Analysis completed	PPE as listed on panel
			Work Planning performs arc flash analysis	PPE as listed on Permit
			No Arc Flash Hazard Analysis	NFPA 70E Cat.4 (40 Cal/cm^2)

Table 2. Protective Clothing Characteristics

NFPA Cat.	PPE Required
	PPE as listed on the cover of the panel. An analysis of the available arc flash energy has been performed and PPE required is specific to this device, but in all circumstances you will require safety glasses with side shields.
0 +	BNL is increasing the NFPA 70E Cat. 0 required PPE (i.e., non-melting, flammable natural materials (untreated 100% cotton, wool, rayon[2], or silk, or blends of these materials with a fabric weight of at least 4.5 oz/yd^2) long-sleeve shirt and long pants) PLUS leather gloves (minimum leather palm with cotton back: BNL # K62980), and safety glasses with side shields. (Cal/cm^2 N/A)
2	Cotton underwear and fire-rated long-sleeve shirts and long pants, hardhat with arc rated face shield: BNL # K64942 (protective storage bag for face shield and hat: K64793), safety glasses, all leather gloves: BNL # K62902, leather work shoes, and hearing protection. (Cal/cm^2 8) (Cotton underwear not required with 8 Cal/cm^2 Fire Rated long-sleeve shirts and long pants)
4	Cotton underwear plus FR shirt and FR pants plus multilayer flash suit, hardhat, safety glasses, Flash Suit hood, hearing protection, leather gloves, and leather work shoes. (Cal/cm^2 40)

Attachment 2

Authorization to Safely Open or Close Breakers or Disconnect Switches as Part of Planned Work Processes

1. List the group and individual who authorized the listed breaker or disconnect switch operation. This may be filled in by the authorized individual, the work planner or the system specialist. This signature indicates that facility conditions are such that breaker or switch operation cannot create an unsafe equipment or system condition and that if the breaker is being closed, the equipment being supplied with energy is in a safe condition to be energized.

   List Breakers/Switch and/or Equipment to be Operated:

   Breaker Operations Authorized by:
   C-AD Group: _____

   Printed Name: _____

   Signature: _____

   Date: _____ Time: _____

2. The work planner shall verify below that work planning of the job[1] was completed by either skill-of-the worker methods or use of a Green Work Permit for medium or high hazard work. The individual assisting with the breaker or switch operation may require review of the jobsite and affected equipment and/or review of the Green Work Permit as they see fit in order to have assurance that no adverse worker safety, environmental impact or equipment damage is expected.

   Work Planning Completed by:
   Printed Name: _____

   Signature: _____

Completed forms shall be retained by the shift or support worker's group performing the breaker or switch operation

[1] This includes pre-job briefing and as appropriate, jobsite walkdown as a minimum for skill-of-the worker jobs.

FIGURE A

Example of GE Spectra Series 400A Fuse Disconnect Switch

FIGURE B

Generic PPE Label

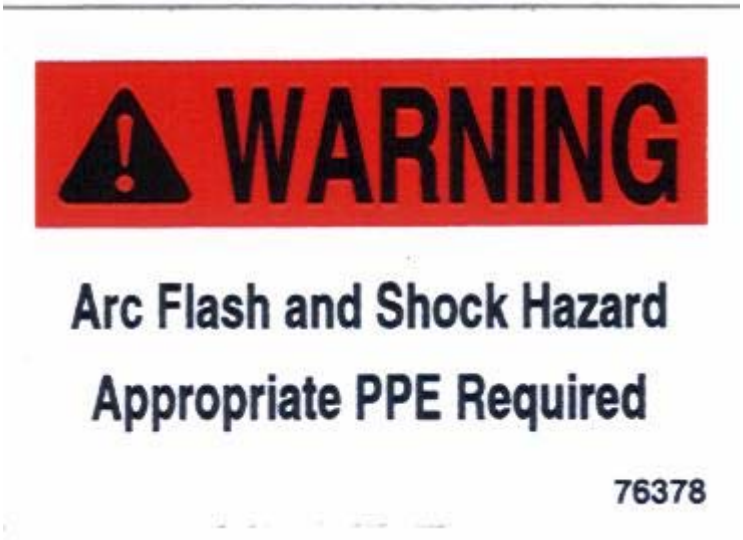

FIGURE C

Example of a Specific PPE Label